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REVISITING THE INVESTMENT DEVELOPMENT PATH (IDP): A NON LINEAR FLUCTUATION APPROACH

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Abstract
The investment development path (IDP) approach claims that countries go through five stages with respect to their net outward investment positions as they develop. Attempts to test its validity using time-series or cross-section estimation techniques were moderately successful and the functional specifications used did not reflect IDP structure well. In this study, we introduce a fluctuation function, which is obtained from the general solution of an exponential function reflecting a continuous compounding process. It has extra properties that help capture the idiosyncratic shape of IDP and gives parameter estimates that facilitate interpretation of the stage a country is at.

Keywords: investment development path, trigonometric function, nonlinear estimation
JEL Codes: C23, F21, F23

1. Introduction

Foreign direct investment (FDI) is the result of internationalization of firms and Dunning (1977, 1981) attributes this process to three main conditions or factors, namely ownership, location and internalization (OLI) advantages. The ownership advantage of a firm depends on its relative competitive advantage such as patents, licences and on its access to raw materials and/or markets. Location advantages belong to the host country and are defined as factors, which increase its attractiveness for FDI such as geographical proximity, labour market specifications, i.e. skill base, wages, and infrastructure, etc. Finally, internalization advantage indicates the advantages that the firms want to exploit themselves rather than

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sharing or selling to other firms through arms-length contracts such as franchising[1]. Investment development path (IDP) theory is actually the extended form of the conditions laid out by Dunning (1981, 1988) for internationalization of firms at the macro level to explain the foreign direct investment stock of countries. It states that a country's *net outward investment* (NOI) position changes as it develops, where the level of development is measured by *gross domestic product* (GDP) and NOI is measured by the difference of outward and inward investment stocks (Dunning and Narula, 1996). The relationship between NOI and development is defined as a five-stage process shown in Figure 1.

In the pre-industrialization period (stage 1), the location advantages of the host country are assumed to be insufficient to attract FDI, and therefore, FDI inflows are a result of natural assets. As would be expected, local firms have not developed ownership (O-) advantages to be able to invest abroad. In the second stage, the outward FDI is very small or negligible but the inflows are increasing as the size and purchasing power of local markets grow. The local firms have some ownership advantages but these are not sufficient to generate more FDI outflows than inflows.

Stage 3 is characterised by a decrease in the growth rate of FDI inward stock accompanied with an increase in the growth of outward stock. At this stage, the governments can promote outward FDI in sectors with high ownership advantages. In the fourth stage, outward and inward FDI stocks are either equal to each other or outward stock is greater than inward stock. As the firms globalize, they become multinationals. In the final stage of development, NOI levels first fall and later fluctuate around zero, where most of the FDI inflows are of either market-seeking or knowledge-seeking nature.

The interest provoked by this theory, promoted many applied works covering developed and developing countries. Some of these

[1] See Dunning (1981 and 1986) and Rugman (1981, 1985 and 1996) for details of internationalization.

adopted econometric methods[2] to validate the systematic and distinctive structure proposed by the theory. In econometric estimations, usually, a specific shape or functional form has been superimposed to capture the fluctuating nature of IDP and linear models are used to estimate time series or cross-section data. Unfortunately, most of these empirical studies have not been able to fully capture the idiosyncratic nature of the IDP relationship and to provide a sound intuition for the specific functional forms chosen.

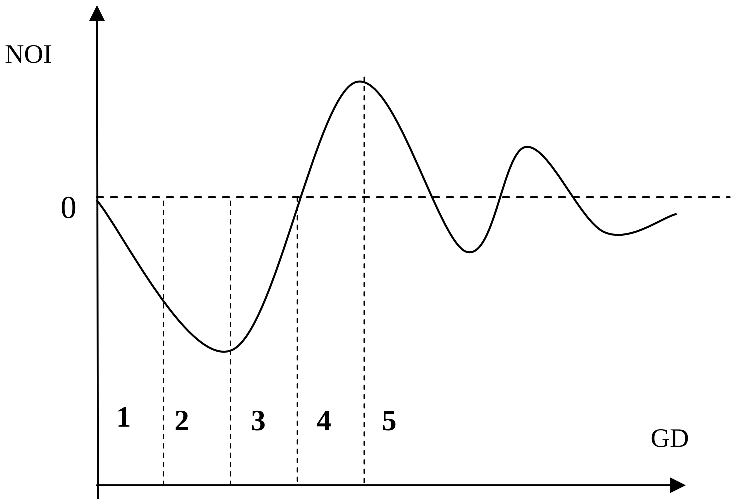

Figure 1. Stages of investment development path.
Source: Dunning and Narula (1996)

This study contributes to the state of knowledge by proposing a fluctuation function form and nonlinear model estimation to test the theory. Our estimation model is based on the continuous nature of the NOI-GDP relationship and the parameter

[2] Graham (1996); Zander and Zander (1996); Akoorie (1996); Calderon, Mortimore and Peres (1996); Hoesel (1996); Zhang and Bulke (1996); Oz and Kildir (2003) and Castro (2004) have all analysed IDP for a number of countries using alternative methods to econometric estimations.

estimates are expected to give evidence for the IDP stage of each country in the sample. The sample covering a panel of 16 OECD countries[3] over the 26 years from 1970 to 2005 is chosen so that the time horizon and development levels of these countries will enable all stages of IDP to be observed.

The rest of the paper is developed as follows. In the second section, we give out a summary of the empirical literature. Section 3 introduces the benchmark model, which follows the line of existing literature. The rationale of the functional form proposed and the methodology is discussed in section 4. Section 5 gives the estimation results followed by the conclusion in section 6.

2. Empirical Literature on IDP

The applied research mainly consists of country studies that either estimate the investment development path through time-series analysis or verify it by analysing the changes in ownership, location and internalization advantages in time and with levels of development. Alternatively, cross-section estimations are also used to analyse the IDP positions of various countries. Dunning and Narula (1996) claim that the static cross-section analysis is not suitable for estimating dynamic nature of IDP. They compare the countries' net outward investment positions with respect to the ownership of natural and created assets by domestic firms. In explaining the NOI, they use GDP as the only explanatory variable and regress net outward investments on *GDP* and GDP^2. This quadratic specification

$$NOI = \beta_0 + \beta_1 GDP + \beta_2 GDP^2 + \varepsilon, \quad (1)$$

is chosen to reflect the U-shaped relationship between NOI and GDP at the earlier stages of IDP. Alvarez (2002) and Barry, Görg and McDowell (2002) also use the same structure to determine the IDP stages of Spain and Ireland, respectively.

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[3] These countries are Australia, Austria, Canada, Denmark, Finland, Germany, Hungary, Ireland, Italy, Japan, Mexico, New Zeland, Norway, Spain, Turkey and UK.

Time-series models of IDP, depending on data availability and on the area focused, researchers make use of a number of variables and various functional forms. For example, Clegg (1996) explains the IDP position of Britain using an IDP coefficient that represents NOI per unit of GDP, among other variables. Campa and Guillen (1996) use additional indicators, such as the number of scientists and engineers, trade volume with bilateral-FDI countries and bilateral FDI/GDP ratios of countries, to explain inward and outward FDI levels of Spain. In analysing Indonesia's investment position Lecraw (1996) develops the analytical structure of IDP by estimating two different models. In the first model, Lecraw employs Indonesia's share of FDI inflows as the dependent variable whereas the growth rate, repressiveness of government policies, prices of natural resources and real exchange rate are taken as explanatory variables. In the second model, the world FDI level and real interest rates are added to the independent variables to explain the share of Indonesia in fixed capital formation of the world.

In contrast to previous studies, Buckley and Castro (1998) opt for a higher degree polynomial rather than the quadratic functional form to estimate Portuguese IDP. The model they use

$$NOI = \beta_0 + \beta_1 GDP^3 + \beta_2 GDP^5 + \varepsilon, \qquad (2)$$

is claimed to perform better in projecting the higher growth rate of inward FDI than of GDP at the first stage. Bellak (2001), on the other hand, utilizes even a higher degree polynomial function while estimating the macro-IDP for Austria[4]:

$$NOI = \beta_0 + \beta_1 GDP + \beta_2 GDP^2 + \beta_3 GDP^3 + \beta_4 GDP^4 + \varepsilon. \qquad (3)$$

Although some of these models provide good fits to the data, as we have noted earlier, the rationale for choosing one model over the other(s) is not apparent and usually it becomes difficult to evaluate the parameter estimates and determine the IDP stages of

[4] In analysing IDP for Austria, Bellak (2000) first uses the polynomial suggested by Buckley and Castro (1998), but later prefers to comment on the changes in NOI position of Austria rather than relying on estimation results.

countries with such models. Most of these models prefer using additional explanatory variables to GDP such as the number of scientists and engineers, trade volume by Campa and Guillen (1996) and real exchange rate by Lecraw (1996) etc. All the same, including variables other than GDP changes the context of research from testing the validity of IDP to explaining FDI flows, which requires a totally different approach. Therefore, we stick to the original idea and employ only GDP to examine the NOI position of a country. Assuming that the main purpose is to analyse the validity of Dunning's initial proposition and to determine the IDP stage of a country, we suggest using a trigonometric function to model the cyclical nature IDP. However, before introducing the nonlinear fluctuation form, we first estimate the standard polynomial functions as benchmark models.

3. Benchmark Model

Country characteristics play an important role in determining the advantages that lead to FDI, therefore all countries do not follow the same path of development. The sample data shows a mixture of structures with respect to country IDPs (see the scatter plot in Figure 2). The summary statistics for the data is given in the Appendix.

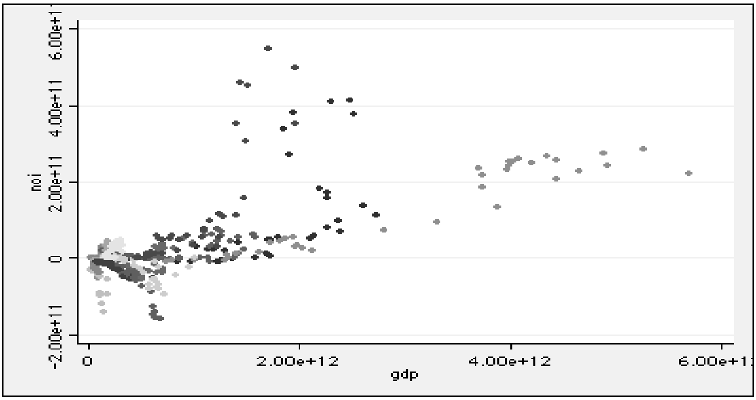


Figure 2. NOI vs GDP scatters for all countries in that sample.

In order to analyse the net outward investment position of these OECD countries, we initially estimate country-wise regressions using GDP as the only explanatory variable for both of the models defined in equation 1 (Model 1) and equation 2 (Model 2).

We have also estimated the same models using GDP per capita as the explanatory variable. The parameter estimates remain fairly robust whether GDP or GDP per capita is used. The latter model, which regresses NOI on GDP^3 and GDP^5, fits better to the data with smaller residual sum of squares (RSS) for most of the countries than the first. Similar to the scatter plot of the actual data, the fitted values also show a mixture of structures (see Figure 3, below).

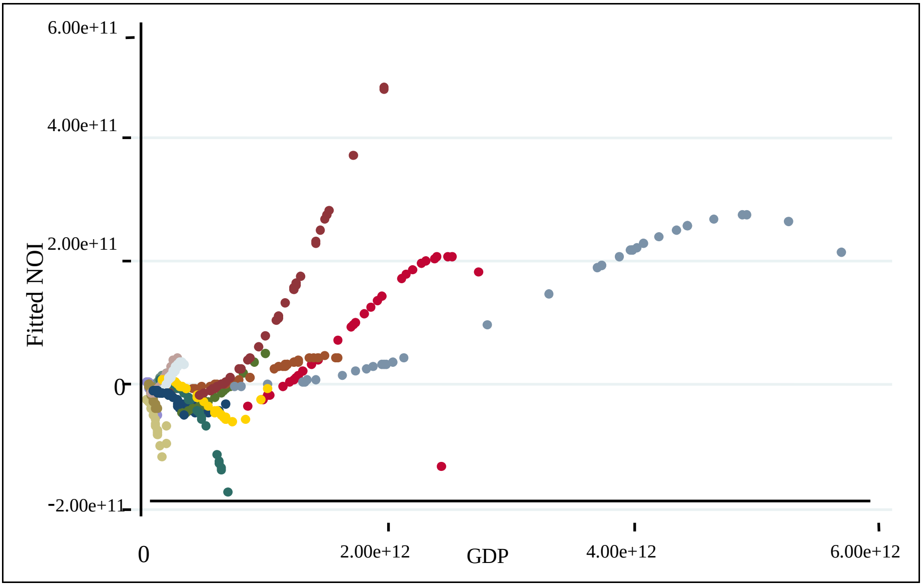


Figure 3. Scatter plots for the fitted values of NOI for the whole sample.

Since pooling countries increases the sample size and helps us to observe the structure tested, we estimate the pooled version of Model 2 to determine the feasibility of this process. The results indicate that pooling is meaningful. After sorting the GDP data for the sample, we divide it into four and place each country in one of the quartiles, according to the number of appearances a country has in each subgroup. Later, we use these subgroups to estimate the relationship between NOI and GDP employing fixed effects estimation technique. The estimation results are given in Table 1.

These estimations comply with the propositions of the IDP theory. Additionally, they indicate that the countries in each quartile are actually quite similar with respect to the path they follow, although some of them are at the earlier stages of development than others. With all these in mind, we now introduce the proposed functional form.

Table 1. Fixed-effects estimation results†

	Quartile 1	Quartile 2	Quartile 3	Quartile 4
GDP^3	-760.661***	32.232***	-3.765***	0.081***
	(45.551)	(6.760)	(0.460)	(0.01)
GDP^5	21444.45***	-330.844***	4.114***	-0.002***
	(1560.016)	(103.856)	(0.515)	(0.0004)
Constant	-7.86×10^9***	-6.06×10^9***	-3.53×10^9	3.33×10^{10}***
	(1.13×10^9)	(1.34×10^9)	(3.36×10^9)	(1.10×10^{10})
# obs.	108	144	180	143
Adj. R^2 (within)	0.7807	0.2571	0.2803	0.3369

Note: The standard deviations are given in parantheses below the coefficient estimates. †Quartile 1: Hungary, Ireland, New Zeland; Quartile 2: Austria, Denmark, Finland, Norway; Quartile 3: Australia, Canada, Mexico, Spain, Turkey; Quartile 4: Germany, Italy, Japan, UK. The*** shows significance at 1%, ** significance at 5%, * significance at 10%.

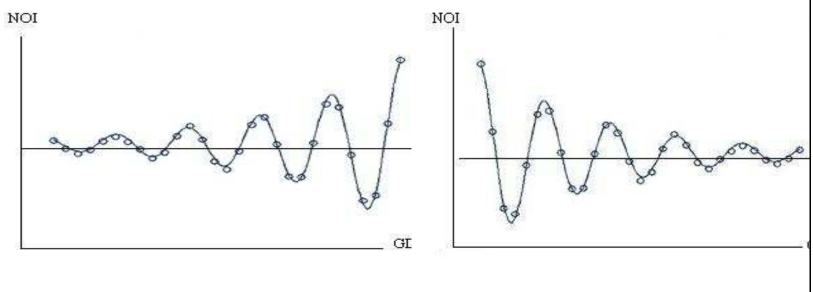
4. Fluctuation Function and Methodology

It is clear from the literature that the earlier stages (1, 2 and possibly 3) of IDP are substantiated by the data and through estimations on various countries. On the other hand, it is not possible to state the same with respect to 4th and 5th stages from available studies. We argue that a cyclical function can give more information about the path IDP follows. In this section, we first present the meaning and fundamentals of the fluctuation form used to model the NOI-GDP relationship and later explain the methodology used.

IDP relates the NOI position of countries to their development, i.e. to GDP. Although GDP and NOI are reported as discrete time variables in statistical tables, in fact, changes in GDP and NOI are continuous. In addition to this continuity, net investment position defined as the stock value is the result of accumulation of capital stock which leads to higher GDP and so on. This continuous change can be defined as a natural exponential function similar to those used in calculating the value of an asset through continuous compounding process. The general solution of such a structure can be expressed in the form of a complementary function with exponential and trigonometric terms, such as $y = e^{ht}(a_1 \cos vt + a_2 \sin vt)$. Here, *h* and *v* represent the horizontal and vertical distance of the cycle from the origin of the circle, respectively. For a continuous compounding process *t* would represent time. After some mathematical transformation[6], the complementary function takes the form of $y = e^{ht} A \cos vt$. As for the path, the complementary function demonstrates the characteristics of a modified cosine function of *t* with amplitude *A* and period $2\pi / v$, i.e. $A(\cos vt + \varepsilon)$, displaying a repeating cycle every time *t* increases by $2\pi / v$. The exponential term e^{ht} has no affect on the cycle itself but shows whether the path converges or

[6] See Lennox and Chadwick (1977); Chiang (1984) and Sydsaeter and Hammond (1995) for the details.

not. If $h > 0$ then the value of e^{ht} increases continuously with *t*. This magnifies the amplitude of the cosine function. In that case, the path becomes an *explosive function* (see Figure 4). If $h = 0$ then $e^{ht} = 1$, causing no change on the cyclical behaviour with constant amplitude, i.e. *uniform fluctuation*. On the other hand, when $h < 0$ then e^{ht} decreases with *t* and this causes the path to converge as a *damped function* (Chiang, 1984).



Explosive function *Damped function*

Figure 4. The paths of explosive and damped functions

Since IDP is assumed to converge towards and fluctuate around zero at the 5th stage, a model attempting to verify this theory should employ a fluctuating functional form in estimations. Hence, the following model is estimated by applying nonlinear estimation:

$$NOI = e^{h(GDP)} A \cos v(GDP) + \varepsilon\,. \tag{4}$$

Here parameter *A*, the *amplitude*, shows the height of the cycle. For a standard cosine function, the amplitude is one and the range of fluctuation is ± 1. The sign of the amplitude parameter matters only in the sense that it indicates whether the cycle starts at the fourth (if *A*>0) or the first (if *A*<0) quadrant of the Cartesian coordinate system. In this model, *A* should be interpreted as the initial amplitude of the cycle whenever $h \neq 0$. As we have already mentioned, *h* is the parameter, which shows converging or diverging behaviour of the

NOI–GDP relationship. Unlike many other models, insignificant *h* parameters cannot be immediately discarded for *h*=0 has a significant meaning in our case, i.e. uniform fluctuation with constant amplitude *A*. The *phase parameter v*, which shows the wave-length, means that the cycle repeats itself every time the independent variable, GDP in this case, increases by $2\pi / v$.

The model imposes nonlinear regression as the estimation methodology since we need to allow the decay parameter *h* to change with each observation. The most general matrix form of a typical nonlinear regression model is written as $y = f(x,\beta) + u$, where β denote the *k* x *1* vector of parameters to be estimated and $f(x,\beta)$ denotes the nonlinear regression function, which varies for each observation. Value of the nonlinear regression function depends on the explanatory variables and its functional form changes over time. The β parameter vector is estimated by minimizing the residual sum of squares given by $RSS(\beta) = \left[y - f(x,\beta) \right]' \left[y - f(x,\beta) \right]$ (Davidson and MacKinnon, 2004; Stata, 2005). This is very similar to the objective function of a classical linear least squares approach but obtaining a parameter vector minimizing its value is not as straightforward. One of the two major differences between the two is that a simple matrix of explanatory variables in the linear form is replaced with a matrix of functions that depend on both the explanatory variables and the parameters. Also, the function $f(x,\beta)$ is nonlinear in β. Since $RSS(\beta)$ is not a quadratic function of β, there is no analytic solution as in the classical case[7].

5. Results

In order to assess the appropriateness of the proposed fluctuation form for the IDP structure, we proceed by first estimating the cyclical model Eq. (6) for the pooled-quartile data as done with the benchmark model above. Later we conduct country-wise estimations,

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[7] We use Stata 9.1 to perform the nonlinear estimations. the numerical minimization algorithm used in Stata 9.1 is based on Newton's method.

which are expected to reflect the individualistic IDP structures resulting from the country-specific characteristics.

The results of the pooled estimations for the fluctuation model are reported in Table 2. The overall picture shows that the decay parameter (*h*) is positive in all quartiles; amplitude (*A*) is negative in Quartiles 1 and 3, zero in Quartile 2 and positive in Quartile 4 whereas the phase parameters (*v*) are positive in all quartiles but Quartile 4.

The positive values of *h* imply an exploding function, i.e. the gap between inward and outward FDI stock is growing, so by looking at the results of group-wise estimations we can say that in none of these quartiles we find a converging structure.

Table 2. Group-wise nonlinear estimation results[†]

	Quartile 1	Quartile 2	Quartile 3	Quartile 4
h (decay)	3.56×10^{-11}***	2.21×10^{-11}***	3.82×10^{-12}***	5.71×10^{-13}***
	(1.38×10^{-12})	(5.59×10^{-12})	(3.19×10^{-13})	(4.03×10^{-14})
A (amplitude)	-2.07×10^{9}***	2.75×10^{8}	-1.21×10^{10}***	7.71×10^{10}***
	(3.58×10^{8})	(2.92×10^{8})	(2.96×10^{9})	(1.06×10^{10})
v (phase)	8.64×10^{-12}***	5.31×10^{-12}***	1.58×10^{-12}***	2.45×10^{-13}
	(4.76×10^{-14})	(4.13×10^{-13})	(3.29×10^{-14})	(1.54×10^{-14})
phase value (b$)	726.85	1182.67	3974.68	---[a]
# observations	108	144	180	143
Adj. R^2	0.9173	03108	0.5565	0.6603

Note: The standard deviations are given in parantheses below the coefficient estimates.[†]Quartile 1: Hungary, Ireland, New Zeland; Quartile 2: Austria, Denmark, Finland, Norway; Quartile 3: Australia, Canada, Mexico, Spain, Turkey; Quartile 4: Germany, Italy, Japan, UK.[a] The phase value for Quartile 4 has not been calculated since the phase parameter is insignificant. *** significant at 1%, ** significant at 5%, * significant at 10%.

Since a negative amplitude parameter (*A*) means that the inward FDI stock is greater than outward then we can conclude that the group of countries in Quartiles 1 and 3 have not reached the fourth stage where the outward stock would be greater than inward. In Quartile 2, parameter *A* is insignificant meaning that the initial NOI position is very close to zero. Evaluated on its own, this shows the beginning of either first or fourth stages. However, though close to zero, the sign of *A*, which is positive in Quartile 2, indicates fourth stage rather than the first. For the third quartile, the amplitude is negative and hence represents a NOI position of pre-fourth stage. The phase value in Quartile 3 is almost triple of the second quartile revealing a larger wave still not converging (*h* is positive as well). In the last quartile, although the phase parameter is insignificant, a positive parameter value for *A* implies the fourth or the fifth stages of IDP. However, a positive *h* signaling an explosive function displays that Quartile 4 does not implicate fifth stage. Table 2 points to the fact that neither of the quartiles represents the fifth stage of IDP. Until *h* becomes negative we cannot talk about the fifth stage.

The phase values ($2\pi / v$) suggest that the cycle repeats itself at different intervals in different quartiles. The increase in phase value from one quartile to the next indicates that as GDP increases, i.e. at higher levels of development, the phase of the cycle lengthens. In other words, as countries develop they need to reach a higher GDP to achieve the same level of NOI at lower development levels. At higher levels of development, the responsiveness of NOI to GDP changes is lower or as the economy grows net outward investment position of the country becomes less and less responsive to this growth. This result actually substantiates the need to revise the classical IDP theory.

In evaluating the individual country positions, we follow the same line of logic based on country-wise estimates shown in Table 3. We only comment on the predicted stages of the country estimations if the explanatory power (R^2) is medium (M) or high (H) given in the last column of Table 3.

Table 3. Country-wise nonlinear estimation results

Country	*h*	*A*	*v*	phase v.	IDP	Adj. R2
Australia	$4.76\ F^{-12}$ ***	$-9.41\ F^{9}$***	$2.21\ F^{-12}$***	2841	2-3	H
	($9.01\ F^{-13}$)	($2.85\ F^{9}$)	($1.21\ F^{-13}$)			0.9097
Austria	$1.13\ F^{-11}$ ***	$-1.43\ F^{9}$***	$5.67\ F^{-12}$***	1107	2-3	H
	($2.14\ F^{-12}$)	($4.89\ F^{8}$)	($1.92\ F^{-13}$)			0.7950
Canada	$9.86\ F^{-13}$	$-3.87\ F^{10}$**	$2.23\ F^{-12}$***	2816	3-4	M
	($6.98\ x10^{-13}$)	($1.80\ F^{10}$)	($1.11\ F^{-13}$)			0.5202
Denmark	$1.35\ F^{-12}$	$-4.61\ F^{9}$	$9.93\ F^{-12}$***	632.4	4	L
	($4.54\ F^{-12}$)	($2.77\ F^{9}$)	($8.21\ F^{-13}$)			0.3203
Finland	$3.48\ F^{-11}$**	$2.22\ F^{8}$	$-7.89\ F^{-12}$***	795.9	4	M
	($1.48\ F^{-11}$)	($3.69\ F^{8}$)	($1.40\ F^{-12}$)			0.6005
Germany	$2.94\ F^{-12}$***	$8.56\ F^{8}$	$5.57\ F^{-13}$***	11274	4	M
	($5.03\ F^{-13}$)	($1.08\ F^{9}$)	($2.00\ F^{-14}$)			0.5997
Hungary	$7.06\ F^{-11}$***	$-4.64\ F^{8}$**	$-1.50\ F^{-11}$***	418.7	2-3	H
	($5.85\ F^{-12}$)	($1.74\ F^{8}$)	($3.14\ F^{-13}$)			0.8738
Ireland	$2.36\ F^{-11}$***	$-1.10F^{10}$***	$-8.31\ F^{-12}$***	755.7	2-3	H
	($1.76\ F^{-12}$)	($1.80\ F^{9}$)	($1.55\ F^{-13}$)			0.9128
Italy	$4.97\ F^{-13}$	$9.59\ F^{9}$	$-1.91\ F^{-13}$	----	4	L
	($4.11\ F^{-12}$)	($1.88\ F^{10}$)	($2.05\ F^{-11}$)			0.3631
Japan	$9.82\ F^{-13}$***	$7.97\ F^{9}$***	$2.58\ F^{-13}$***	24341	4	H
	($4.37\ F^{-14}$)	($1.78\ F^{9}$)	($5.85\ F^{-15}$)			0.9636
Mexico	$-2.36\ F^{-28}$	$-3.35\ F^{-12}$*	$-1.21\ F^{-26}$	----		0
	($2.99\ F^{-12}$)	($1.73\ F^{10}$)	($4.99\ F^{-11}$)			
New Zealand	$7.32\ F^{-11}$***	$-2.88\ F^{8}$*	$1.52\ F^{-11}$***	413.2	2-3	H
	($7.81\ F^{-12}$)	($1.43\ F^{8}$)	($3.94\ F^{-13}$)			0.8468
Norway	$1.41\ F^{-11}$***	$2.00\ F^{9}$	$-2.91\ F^{-11}$***	215.8	4	M
	($3.12\ F^{-12}$)	($1.25\ F^{9}$)	($5.26\ F^{-13}$)			0.5356
Spain	$6.14\ F^{-12}$***	$-1.72\ F^{9}$	$1.59\ F^{-12}$***	3949	3-4	M
	($8.75\ F^{-13}$)	($1.05\ F^{9}$)	($2.36\ F^{-14}$)			0.6533
Turkey	$-3.64\ F^{-28}$	$-1.42\ F^{10}$***	$-2.05\ F^{-26}$	----		0
	($1.71\ F^{-12}$)	($2.01\ F^{9}$)	($6.19\ F^{-11}$)			
United Kingdom	$-3.81\ F^{-28}$	$1.22\ F^{11}$	$-5.71\ F^{-27}$	----		0
	($1.55\ F^{-12}$)	($9.73\ F^{10}$)	($1.02\ F^{-11}$)			

Note: $F^{p}=10^{p}$, v.=value, IDP stage show our predictions. ***,**,* means significant at 1%, 5% and 10%, L=Low (<0.5), M=Medium (between o5.and 08) and H=high.

The decay parameter *h* is insignificant for Canada, Denmark, Italy, Mexico, Turkey and the UK. We interpret this as uniform or near uniform fluctuation. Since a negative amplitude means inward FDI being greater than outward FDI, countries with a significant negative amplitude and a positive significant decay parameter is predicted to be at the second or third stage of IDP.

These countries are Australia, Austria, Hungary, Ireland and New Zealand. However, the estimation for Canada shows a uniform fluctuation with negative amplitude. This indicates that the cycle is not expanding nor decaying but at the beginning of the period the inward FDI is more than outward. This is possible only when the country is passing from third to the fourth stage.

For Spain, we observe that the fluctuation is expanding but the amplitude is zero. This points out the beginning of the fourth period. The same argument is valid for Finland, Germany, Japan and Norway as well. The other fourth stage country is Denmark with uniform fluctuation. Among the fourth stage countries Japan has the largest cycle GDP level (phase value) followed by Germany and Spain. Although Italy is another fourth stage country, we cannot calculate its phase value for *v* is insignificant. We do not comment on or predict the IDP stage of Mexico, Turkey and the UK because the estimations have no explanatory power.

Among countries that were explained better by the model (with high explanatory power), only Japan is predicted to be in the fourth stage, all others being either in the second or third stage of their IDPs. All the countries, which the model had medium explanatory power, are at the fourth stage. Canada and Spain passed from third to the fourth stage in the 1970-2005 period, whereas all others were already at the fourth stage in the beginning of the period we consider.

6. Conclusion

In an attempt to provide a superior and highly explanatory alternative to the functional forms used in estimating the IDP theory, we have worked with a fluctuation function, which has a decay property. Our findings indicate that every country has their own individual IDP structures although the basics are common. The fluctuation function we employ in this paper allows us to determine the IDP stage by interpreting the parameter estimates, which is a contribution in its own right since that wasn't possible in the previous studies.

The comparison of the benchmark model with our proposed nonlinear model displays a number of points to be discussed. First of all, the benchmark model, which follows the existing literature, generates parameter estimates that are difficult to interpret. However, the parameter estimates obtained from the fluctuation function have clear meanings. Secondly, it is difficult to link the parameter estimates obtained from the benchmark model to IDP stages. On the other hand, by examining the estimates of amplitude, decay and phase parameters and their cross affect, one can determine the IDP stage of a country with more ease. Finally, the models in the literature do not have the tools to determine whether the path is actually decaying or not. However, the proposed function actually calculates the decay parameter with every observation and thus provides evidence about whether the country has reached the last stage or not.

Additionally, comparing the results we get from the nonlinear estimations with some country studies from the literature shows that the fluctuation function proposed in this paper as an alternative to the functional forms used in explaining the IDP structure, has superior properties. For example, Akoorie (1996)'s arguments on the NOI position of New Zealand confirms our findings that the country is a stage 2 country at the beginning of the period (1970) and a stage 3 country at the end. With respect to the Spanish case, Campa and Guillén (1996) express their expectation that the Spanish firms will expand internationally and outward FDI flows will increase. Since, this view was stated in early 1990s, we can conclude that our estimation of Spain being a-stage-3 country finds support in Campa and Guillén (1996). Similarly, the u-shaped figure of Irish IDP and arguments put forward by Barry, Görg and

McDowell (2002) comply with our finding that Ireland is a stage 3 country.

Moreover, using this cyclical structure, we have introduced the notion of IDP changing with development levels, i.e. it is not possible to talk about a given path that each country follows but the path itself changes as the country becomes more developed. A step forward would be to include this dynamic phase structure we have shown into the fluctuation function. In that way, the range of cyclical movements would be endogenized in the model.

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Appendix. Table A1. Summary Statistics

	Gross Domestic Product (bn$)				Net Outward Investment (bn$)			
Country	Mean	SD	Min.	Max.	Mean	SD	Min.	Max.
All Countries	584.5	880	15.4	5694	12.2	81.5	-160	546
Quartile 1	50.69	28.8	15.4	179	-20.7	25.2	-139	1.33
Quartile 2	134.9	53.0	40.5	272	1.02	10.6	-11.3	45.3
Quartile 3	381.0	206	59.1	1000	-23.8	32.5	-160	49.8
Quartile 4	1689	1167	396	5694	93.1	125	-10.8	546
Australia	350.9	104	160	651	-34.0	12.8	-55.4	-2.08
Austria	164.9	62.8	55.3	272	-4.38	2.59	-8.56	4.99
Canada	581.8	149	309	990	-14.8	31.7	-56.2	49.8
Denmark	139.8	44.9	60.2	230	-0.80	3.82	-8.79	10.3
Finland	107.4	36.7	40.5	171	7.23	9.63	-1.10	28.7
Germany	1733	563	719	2739	99.1	133	-10.8	414
Hungary	42.53	17.5	20.1	98.1	-8.93	14.9	-51.8	0.38
Ireland	59.76	42.4	15.4	179	-43.5	27.9	-139	-28.2
Italy	961.8	362	396	1580	20.7	27.6	-8.41	74.8
Japan	3028	1452	736	5694	131	110	-7.44	284
Mexico	345.1	158	129	682	-33.4	53.1	-160	18.7
N. Zealand	49.78	16.6	23.9	97.2	-9.69	12.0	-36.5	1.33
Norway	127.5	49.0	46.3	262	2.03	16.6	-11.3	45.3
Spain	476.5	219	144	1000	-22.5	31.5	-92.8	14.0
Turkey	150.6	58.1	59.1	323	-14.2	7.26	-49.9	-9.85
UK	1032	417	448	1958	121.5	159	0.26	546

Data Both the FDI inward and outward stock data and the GDP data are obtained from UNCTAD.